

A RE-EVALUATION OF *CAREX SPECUICOLA* AND THE *CAREX PARRYANA* COMPLEX (CYPERACEAE)

A.A. Reznicek

University of Michigan Herbarium
3600 Varsity Drive
Ann Arbor, Michigan 48108-2228, U.S.A.
reznicek@umich.edu

D.F. Murray

University of Alaska Museum of the North
907 Yukon Drive
Fairbanks, Alaska 99775-6960, U.S.A.
dfmurray@alaska.edu

ABSTRACT

We review the systematics and provide a key for the *Carex parryana* complex (sect. *Racemosae*). *Carex specuicola* is recognized as a hanging gardens endemic, while a similar species, ***C. utahensis***, is found in a diversity of wetlands in Utah and westernmost Colorado. We reinstate "*C. aboriginum*" of older literature as a good species with the new name of *C. holmgreniorum*. We confirm the distinctness of *C. hallii*, *C. idahoa*, and *C. parryana* and provide additional characters for distinguishing these taxa. The type of *Carex hallii* is reinterpreted to be consistent with the protologue. A lectotype is chosen for *Carex idahoa*.

RESUMEN

Se revisa la sistemática y se aporta una clave para el complejo de *Carex parryana* (sect. *Racemosae*). *Carex specuicola* se reconoce como endemismo de jardines colgantes, mientras que una especie similar, ***C. utahensis***, se encuentra en varios humedales de Utah y extremo occidental de Colorado. Se reinstaura "*C. aboriginum*" de la bibliografía antigua como una buena especie con el nuevo nombre de *C. holmgreniorum*. Se confirma la diferencia de *C. hallii*, *C. idahoa*, y *C. parryana* y se aportan caracteres adicionales para distinguir estos taxa. Se reinterpreta el tipo de *Carex hallii* para que sea consistente con el protólogo. Se elige un lectotipo para *Carex idahoa*.

INTRODUCTION

Plants referred to *Carex parryana* Dewey have always been a source of taxonomic difficulty. Adding to this difficulty is that, even though some species are widespread, all are uncommon or rare. *Carex parryana* and its close relatives differ from other members of section *Racemosae* in having \pm elongated inflorescences that have relatively narrow (2.4–6.8 mm wide), cylindrical, erect or ascending lateral spikes (if not unispicate), combined with small perigynia 1.7–3.3 mm long (–3.9 in *C. specuicola* and *C. utahensis*). Mackenzie (1935) recognized four species in this complex, *C. aboriginum* M.E. Jones, *C. hallii* Olney, *C. idahoa* L.H. Bailey, and *C. parryana*. Murray (1969) recognized *C. parryana* as one variable species consisting of distinct races in the southern Rocky Mountains, and treated them as subspecies; *C. parryana* subsp. *hallii* (Olney) D.F. Murray, *C. parryana* subsp. *idahoa* (L.H. Bailey) D.F. Murray and *C. parryana* subsp. *parryana*. He did not treat *C. aboriginum*, realizing that "*Carex aboriginum*" as described in Mackenzie (1935) was close to *C. parryana* and a quite different plant than *C. aboriginum* M.E. Jones, which is a local Idaho endemic with much larger perigynia (4.7–)5–6.6 mm long very similar to *C. serratodens* W. Boott (Murray 2002). Hermann (1970) recognized *C. hallii*, *C. idahoa*, *C. parryana*, and *C. aboriginum* M.E. Jones as species, but noted that "*Carex aboriginum*" as described in Mackenzie (1935) is "completely different" from M.E. Jones's type's type. He treated *C. aboriginum* of Mackenzie, not M.E. Jones, as *C. parryana* var. *brevisquama* F.J. Herm. Murray (2002) treated *C. idahoa*, *C. hallii*, *C. parryana*, and *C. aboriginum* as species, and also noted that Mackenzie's "*C. aboriginum*" was not *C. aboriginum* of M.E. Jones, but did not recognize *C. parryana* var. *brevisquama*. Finally, Goodrich (in Welsh et al. 2003) concluded that *C. specuicola*, described by Howell (1949) as an endemic of hanging gardens in northern Arizona, also belonged within *C. parryana*, and recognized only *C. parryana* in Utah.

In the last decade of floristic activity within the range of the *Carex parryana* complex, there has fortunately been enough collecting to generate a great many new specimens. This was especially true for *Carex specuicola*, for which few specimens existed when it was treated for Flora of North America, (Murray 2002). Botanists working with the Navajo Nation (see Roth 2004) discovered a number of new populations, and we

now have an excellent series of specimens to study. We reviewed these new collections with several questions in mind. Is *C. specuicola* a good species? Is recognition of *C. hallii*, *C. idahoa*, and *C. parryana* as species supported by additional collections? Finally, what is the identity of "*Carex aboriginum*" of Mackenzie (1935) not M.E. Jones (= *C. parryana* var. *brevisquama* F.J. Herm.), and is it a good species? We also provide illustrations of all the poorly known entities.

RESULTS

Plants referred to *Carex parryana* divide into two clear groups based on morphology and geography. One group, including *C. specuicola*, has strongly flattened perigynia much larger than and loosely fitting over the achenes, an admixture of 2-styled and 3-styled flowers, and is essentially confined to Utah and Arizona. The other group, including *C. hallii*, *C. idahoa*, *C. parryana*, and "*C. aboriginum*" of Mackenzie not M.E. Jones, with the perigynia tightly enveloping the achene and entirely 3-styled flowers, is widespread, occurring from Ontario to Alaska, but south only to Colorado, Utah, Nevada, and California.

The former group, with loosely fitting perigynia and a mix of 2-styled and 3-styled flowers consists of two species. One is the lax hanging garden endemic *Carex specuicola* with pale perigynia. In addition, we recognize an essentially allopatric and more widespread species from a diversity of wetland habitats that is usually stiffly upright, with clearly purple-tinted perigynia, which we describe as *C. utahensis*. In the latter group, with perigynia tightly enveloping the achenes, the plants erroneously referred to *Carex aboriginum* by Mackenzie (1935), and later described as the poorly known *C. parryana* var. *brevisquama* stand out clearly by having large perigynia 2.5–3.3 mm long and 1.5–2.3 mm wide, broad achenes 1.3–1.6 mm wide, and broad lateral spikes, the widest 4–6.8 mm wide. We recognize this taxon at species rank and describe it herein as *C. holmgreniorum*. The remaining three entities, *C. hallii*, *C. idahoa*, and *C. parryana* have smaller perigynia 1.7–2.8 mm long and 0.9–2 mm wide, narrower achenes 0.8–1.2 mm wide, and often narrower (or no) lateral spikes at most to 3.6 mm (5.5 mm in *C. idahoa*) wide. These three remaining species of the *Carex parryana* complex as recognized in Murray (2002) are re-evaluated and confirmed as distinct, with additional diagnostic features that appear to be stable with the larger sample now available.

Carex idahoa is the most easily distinguished entity. It has dark pistillate scales, which are clearly longer than the subtended perigynia, and are frequently sharply pointed. In contrast, *C. hallii* and *C. parryana* have paler, usually rounded-obtuse to acute scales shorter than to about as long as the subtended perigynia. The lateral spikes of pistillate plants, present in about 75% of culms, are also relatively broad, 3–5.5 mm wide. Lateral spikes of *C. hallii* and *C. parryana* (always pistillate) are (2.2–)2.4–3.6 mm wide.

Carex hallii and *C. parryana* show great variability in inflorescence size, spike number, and spike sexuality. Nevertheless, most culms of *Carex hallii* (87% of a herbarium sample of 106 inflorescences) had only one or two spikes (i.e., a terminal spike and a single lateral spike), while less than 5% of a similar sample of *C. parryana* inflorescences had only 2 spikes (none having only one). Figure 1 shows the strikingly different distribution of spike number in these two species. In those culms of *C. hallii* with inflorescences bearing more than one spike, and thus potentially confusable with *C. parryana*, the terminal spike is usually more than twice as long as the longest lateral spike. In *C. parryana*, the terminal spike is usually less than twice as long as the longest lateral spike. In addition, *C. parryana* is a larger plant, with culms often as tall as 35–60 (–70) cm, while *C. hallii* is rarely more than 35 cm tall. Figure 2 contrasts the terminal spike length/longest lateral spike length with culm height for culms of *C. hallii* with multispicate inflorescences and *C. parryana*. This figure also shows that *C. hallii* and *C. parryana* do not represent two ends of a uniform spectrum of variation in size and inflorescence structure, but show this variation arrayed in distinctively different patterns.

KEY TO THE CAREX PARRYANA GROUP

1. Achenes occupying only the proximal $\frac{1}{2}$ – $\frac{2}{3}$ of the perigynium, distal portion and sides empty; perigynia herbaceous to membranous, strongly flattened or concavo-convex.
2. Culms flexuous, spreading and arching; perigynia broadly elliptic, green to pale brown distally, purple tinged only near the base of the beak, whitish hyaline proximally, achene clearly visible through the perigynium; pistillate scales

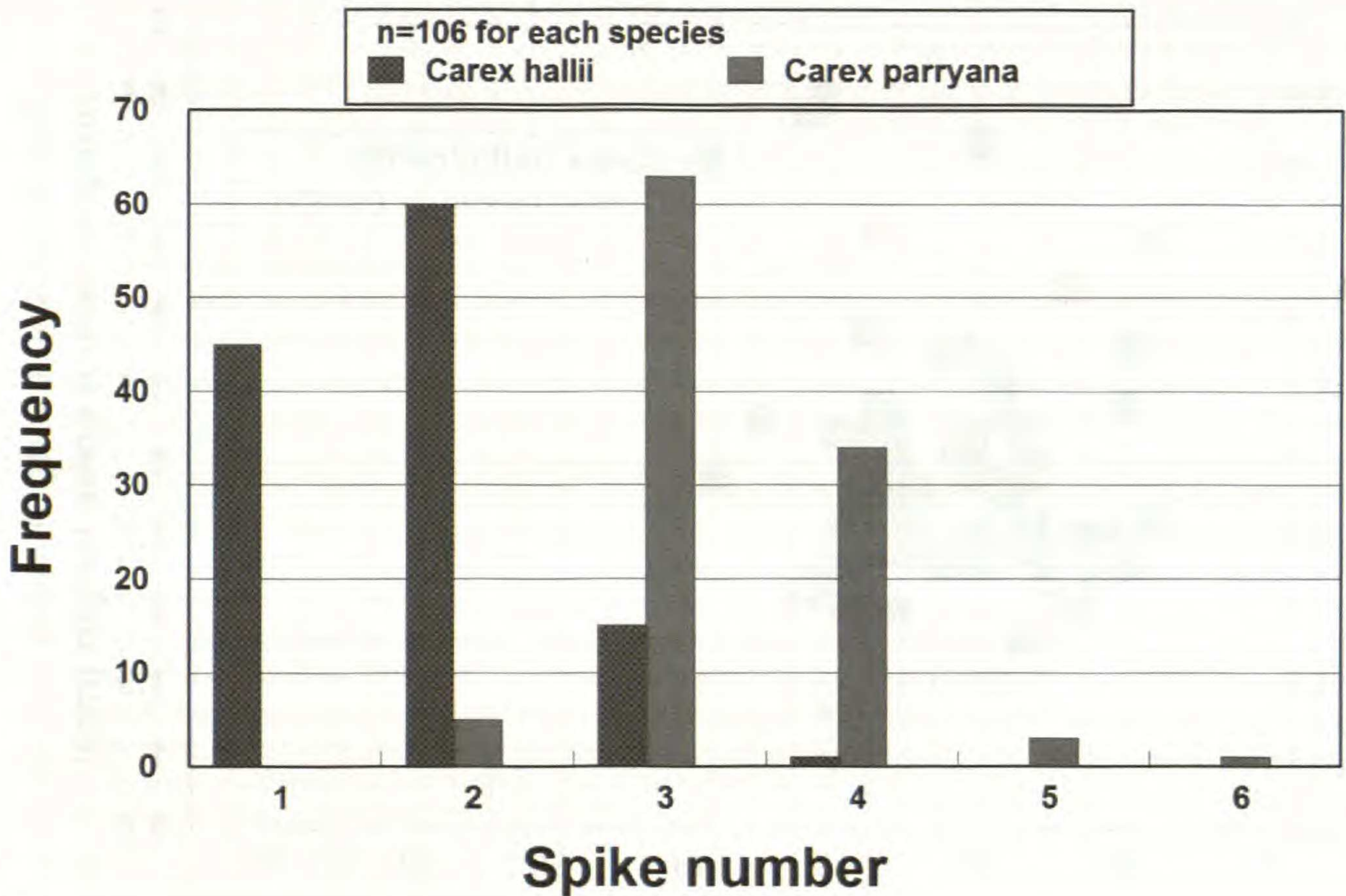


FIG. 1. Distribution of spike numbers in *Carex hallii* and *C. parryana*.

0.9–1.5 mm wide, reddish-brown with broad hyaline margins; stigmas mostly 2 (up to ca. 30% 3); “hanging gardens”

1. *Carex specuicola*

2. Culms stiff, erect and straight; perigynia obovate, strongly purple tinged distally, greenish and opaque proximally, achene not clearly visible through the opaque perigynium; pistillate scales 1.3–1.9 mm wide, deep purple-brown with narrow, inconspicuous hyaline margins; stigmas mostly 3; various wet habitats

2. *Carex utahensis*

1. Achene ±filling the perigynium; perigynia coriaceous, ±rounded trigonous to plumply biconvex, not strongly flattened.

3. Pistillate scales dark reddish-brown to purple-black, the largest (at middle of terminal spikes) (2.5–)3–4.2 mm long, the proximal scales acute to acuminate and clearly exceeding the perigynia

6. *Carex idahoensis*

3. Pistillate scales pale reddish-brown to reddish-purple, the largest (at middle of terminal spikes) 1.6–3(–3.2) mm long, rounded-obtuse to acute, shorter than to about as long as the perigynia.

4. Achenes 1.3–1.6 mm wide; lateral spikes always present, the largest 4–6.8 mm wide

3. *Carex holmgreniorum*

4. Achenes 0.8–1.2 mm wide; lateral spikes present or absent, if present, then ca. (2.2–)2.4–3.6 mm wide.

5. Spikes (2–)3–4(–6), the terminal spike usually gynaeandrous, less commonly male or female, mostly 0.7–2(–2.3) times as long as the longest lateral spike; perigynium body below the base of the beak papillose and usually with at least some short, pointed hairs, especially on the angles

4. *Carex parryana*

5. Spikes 1–3(–5), usually unisexual, if spikes more than one, then the terminal spike (1.8–)2–5.5 times as long as the longest lateral spike; perigynium body below the base of the beak ±papillose but usually lacking short, pointed hairs

5. *Carex hallii*

1. *Carex specuicola* J.T. Howell, Leaflet West. Bot. 5:148. 1949. TYPE: UNITED STATES. ARIZONA: COCONINO Co.: along trail from Inscription House Post to Inscription House Ruin, 23 Jun 1948, J.T. Howell 24609 (HOLOTYPE: CAS 342553!; ISOTYPES: MICH!, NY!).

Loosely cespitose to slightly colonial from slender, ±elongate rhizomes 0.9–2.3 mm wide, rhizomes ca. 0.5–7 cm long between shoots, rhizome scales pale brown, rapidly disintegrating into fibers; culms (7.5–)19–70(–115) cm, lax, flexuous and arching or drooping, trigonous, smooth to finely papillose, 0.5–1 mm wide immediately below the inflorescence; phyllopodic, cataphylls and basal sheaths pale to dark brown, youngest sometimes tinged reddish-purple. Leaves 5–11, essentially basal; blades 1.8–38 cm long, 0.8–3.3(–4.5) mm wide, much shorter than culms, ±folded, the margins and midrib smooth to finely antrorsely scabrous distally,

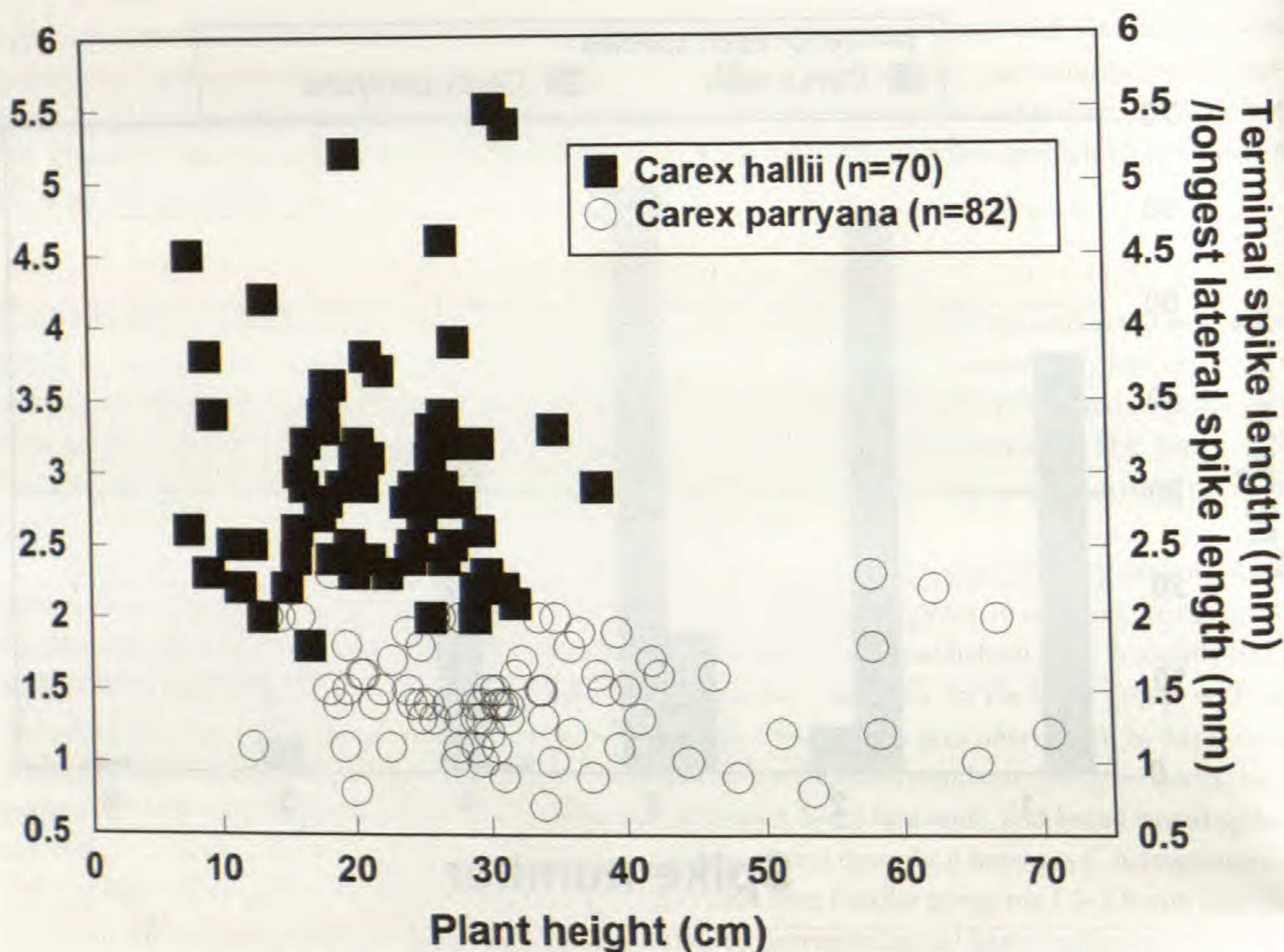


FIG. 2. Plant height versus spike proportion in *Carex hallii* and *C. parryana*.

±smooth adaxially, ±papillose abaxially, especially distally; leaf sheaths 1.5–13 cm long, glabrous, ventrally whitish or pale brown, sometimes finely brown streaked, hyaline, thin, concave at the apex; ligules ca. (1.5–)2–8(–10) mm long, obtuse or retuse to long-acute, longer than wide, at least on the uppermost culm leaves, free portion whitish to pale brown. Inflorescences 1–9.5(–11.5) cm long, with (1–)2–4(–5) spikes, terminal gynaeandrous or occasionally staminate, pistillate, or mixed, laterals pistillate; lateral spikes separate or uppermost ±overlapping, the lower two spikes 0.3–2(–8) cm distant, lowermost ±sessile or on a smooth to ±papillose peduncle up to 13(–18) mm long; lowermost bracts ±bristle-like to leaf-like, blades 1.3–12 cm long up to 2.1 mm wide, sheathless, upper bracts abruptly reduced. Terminal spike 9–29 mm long, pistillate portion (0–)1.8–17 mm long, 3.3–6.5 mm wide, ca. (0–)3–45-flowered, staminate portion (0–)3.3–23 mm long, 1–2.6 mm wide, ca. (0–)4–60-flowered, peduncle 1.2–13.2 mm long. Lateral spikes 5–31 mm long, 2.7–5.2 mm wide, cylindrical, lowest occasionally with a small branch, densely flowered with ca. 5–60 ascending perigynia. Staminate scales 2.6–4.9 mm long, 1.1–1.6 mm wide, narrowly obovate, pale brown to reddish-brown with hyaline margins, apex ±obtuse to acute or acuminate, green, 1–3-nerved center, sometimes prolonged into a ±scabrous-ciliate apiculus or short awn up to 1.5 mm long. Pistillate scales 1.6–3.2 mm long, 0.9–1.4(–1.7) mm wide, pale brown to reddish-brown with conspicuous hyaline margins, ovate to ±oblong, obtuse to acute, green 1–3-nerved center sometimes prolonged into a scabrous-ciliate apiculus or awn up to 1.1 mm long. Perigynia 2.4–3.8 mm long, 1.2–2.2 mm wide, ±strongly flattened in cross-section, broadly to narrowly elliptic, not filled by the much smaller achene, ±membranous, somewhat papillose distally, green to brown on the upper margins and sides, often reddish-purple tinged near the base of the beak, otherwise whitish hyaline and ±translucent, 2-nerved, tapering to a short stipitate base, ±abruptly contracted into a cylindrical beak; beaks 0.2–0.45 mm long, smooth to somewhat papillose, sometimes slightly setulose, green to purplish-brown, apex ±erose to bidentulate with teeth up to 0.2 mm long. Achenes 1–1.9 mm long, 0.8–1.35 mm wide, concavely tapering to a slender

stipe 0.2–0.45 mm long, lenticular or occasionally flattened-trigonous in cross section; the convex sides elliptic to nearly circular in lenticular achenes, narrowly elliptic in trigonous achenes, brown, smooth; apex apiculate with an apiculus up to 0.15 mm formed by the persistent style base; the style deciduous; stigmas mostly 2, sometimes up to 30% 3. Anthers 3, 1.2–2.7 mm long, with a conspicuous apiculus ca. 0.1–0.3 mm long.

Moist seeps in shallow caves or alcoves along sandstone cliffs—“hanging gardens.” *Carex specuicola* occurs as local populations consisting of a few culms to as many as 400–500 plants spread over many meters of the cliff face. Elevation 1350–2325 m. Endemic to northern Arizona and immediately adjacent southernmost Utah.

This is an endemic of Navajo sandstone “hanging gardens.” Typical associated species of hanging gardens in the region include *Adiantum capillus-veneris* L., *Anticlea vaginata* Rydb., *Aquilegia micrantha* Eastw., *Cirsium rydbergii* Petr., *Epipactis gigantea* Hook., *Mimulus eastwoodiae* Rydb., *Platanthera zothecina* (Higgins & S.L. Welsh) Kartesz & Gandhi, and a few other *Carex*, especially *C. hassei* L.H. Bailey. Though very local, this species can form a dense turf and is the dominant cover in some sites. The lax, arching habit remains constant even when the plants are growing on a horizontal surface as shown in Figure 3, though this can be difficult to discern in herbarium material. A sampling of perigynia, scales, and achenes are noted in Figure 4B and a typical inflorescence from a herbarium specimen is shown in Figure 5B.

Representative specimens. **ARIZONA. Apache Co.:** Canyon del Muerto above jct with Canyon de Chelly, 5 May 2001, Rink 258 (NAVA, ASC); narrow canyon SW of Immanuel Mission, 27 Apr 1995, Hevron 2276 (NAVA); Carson Mesa, 12 Jun 2001, O’Kane, Jr. et al. 5373 (NAVA, ISTC); E side of Chinle Wash ca. 6 mi S of Tes Nez Iah and Hwy 160, 24 Sep 2003, Roth 1735 (NAVA); Walker Creek, 1 mi S of Hwy. 160 and Mexican Water, 21 Aug 2003, Roth 1701 (NAVA); Tseyi-hatsosi Canyon N of Kayenta and SW of Boot Mesa, 23 Jul 1991, Hevron 1340 (NAVA); N of Giant Canyon trail, 20 May 2002, Rink 1154 (ASC, BRY); Dancing Rocks NE of Rock Point, 21 Aug 2003, Roth 1699 (NAVA). **Coconino Co.:** canyon S edge of Gray Mesa, 13 Jul 1989, Hevron 214b (NAVA); tributary to Navajo Creek, vic. of confluence with Potato Canyon, 11 Sep 2003, Roth 1713 (NAVA). **Navajo Co.:** head of Far End Canyon N of Geshi Canyon, 30 Sep 2003, Roth & R. Lamberson 1744 (NAVA); Tsegi watershed, Dowozhiebito Canyon, 2 Oct 2000, Roth & Rink 923 (NAVA); Jackass Canyon, 1 Aug 2000, Roth & Holiday 841; small spring, W side of Long Canyon, Skeleton Mesa, 18 May 2004, Rink & Bungart 3146 (ASC, SJNM, NAVA); spring at end of Keet Seel Canyon, 13 Sep 2000, Rink s.n. (NAVA); Adah Chiji Yahi Canyon, 24 May 2001, Clifford & Heil 01-455 (NAVA); Nokai Canyon below Calamity Cave ruin, 16 Oct 2000, Roth & Hodgson 956 (NAVA); Inscription House Spring, approx 10 mi NE of Shonto, 19 Aug 2011, Licher 3210 (MICH). **UTAH. San Juan Co.:** E tributary to Chinle Wash ca. 1.5 mi S of San Juan R, 22 Aug 2003, Roth 1705; Slickhorn Canyon vic. jct with San Juan R., 5 Jun 1997, Atwood et al. 22571 (BRY); 3 mi above San Juan R on Slickhorn Canyon, 5 Jun 1997, Atwood & Furniss 22580 (BRY, KHD).

2. *Carex utahensis* Reznicek & D.F. Murray, sp. nov. TYPE: UNITED STATES. UTAH. San Juan Co.: Angel Arch Canyon, T31S, R20E, Sects. 19, 29, 30, sandy canyon bottom and juniper-pinyon covered slope, ca. 5,500 ft, 2 Jun 1964, S.L. Welsh, G. Moore, & S.G. Canter 2998 (HOLOTYPE: BRY!).

Loosely cespitose to colonial from ±elongate rhizomes 1.3–2.7 mm thick, rhizomes ca. 1–5 cm long between shoots, rhizome scales brown to purplish-brown, disintegrating into coarse fibers; culms 22–55 cm, stiff, ±erect, trigonous, papillose, 0.5–1.4 mm wide immediately below the inflorescence; phyllopodic, cataphylls and basal sheaths brown, the youngest often reddish-purple. Leaves 6–12, essentially basal; blades 3.8–35 cm long, 1.8–4.5 mm wide, much shorter than culms, ±folded, margins and midrib smooth to finely antrorsely scabrous distally, ±smooth adaxially, papillose abaxially; leaf sheaths 1.7–15 cm long, glabrous, ventrally whitish or pale brown, hyaline, thin, shallowly concave at the apex; ligules ca. 0.8–3.7 mm long, acute to rounded, shorter than wide, free portion whitish to pale brown. Inflorescences 2.4–8 cm long, with (2–)3–5(–6) spikes, terminal gynaeandrous or occasionally staminate, pistillate, or mixed, laterals pistillate; lateral spikes overlapping or the lower separate, lower two spikes 1.3–3.3 cm distant, lowermost ±sessile or on a papillose peduncle up to 13.7 mm long; lowest bracts ±bristle-like up to 5 cm long and 1.8 mm wide, sheathless, upper bracts abruptly reduced. Terminal spike 12–31 mm long, pistillate portion (0–)3.7–19.2 mm long, 4.5–7.8 mm wide, ca. (0–)6–50-flowered, staminate portion (0–)6–24.5 mm long, 1.8–3.1 mm wide, ca. (0–)20–65-flowered, peduncle 1.8–11.5 mm long. Lateral spikes 4–22.8 mm long, 3.5–6 mm wide, cylindrical, densely flowered with ca. 7–40 ascending perigynia. Staminate scales 2.3–3.7 mm long, 1.2–1.9 mm wide, obovate, reddish-brown to purple with narrow hyaline margins, especially distally, apex acute to obtuse or rounded, the green, 1–3-nerved center rarely prolonged into a ±scabrous-ciliate apiculus or short awn up to 0.5 mm long. Pistillate scales 1.9–3.3 mm long, 1.3–2.2 mm wide, reddish-brown to reddish-purple, hyaline margins inconspicuous, ovate to ±oblong, obtuse to acute, the green 1–3-nerved center sometimes prolonged into a scabrous-ciliate



FIG. 3. *Carex specuicola* inflorescences from Inscription House Spring, Coconino County, Arizona.

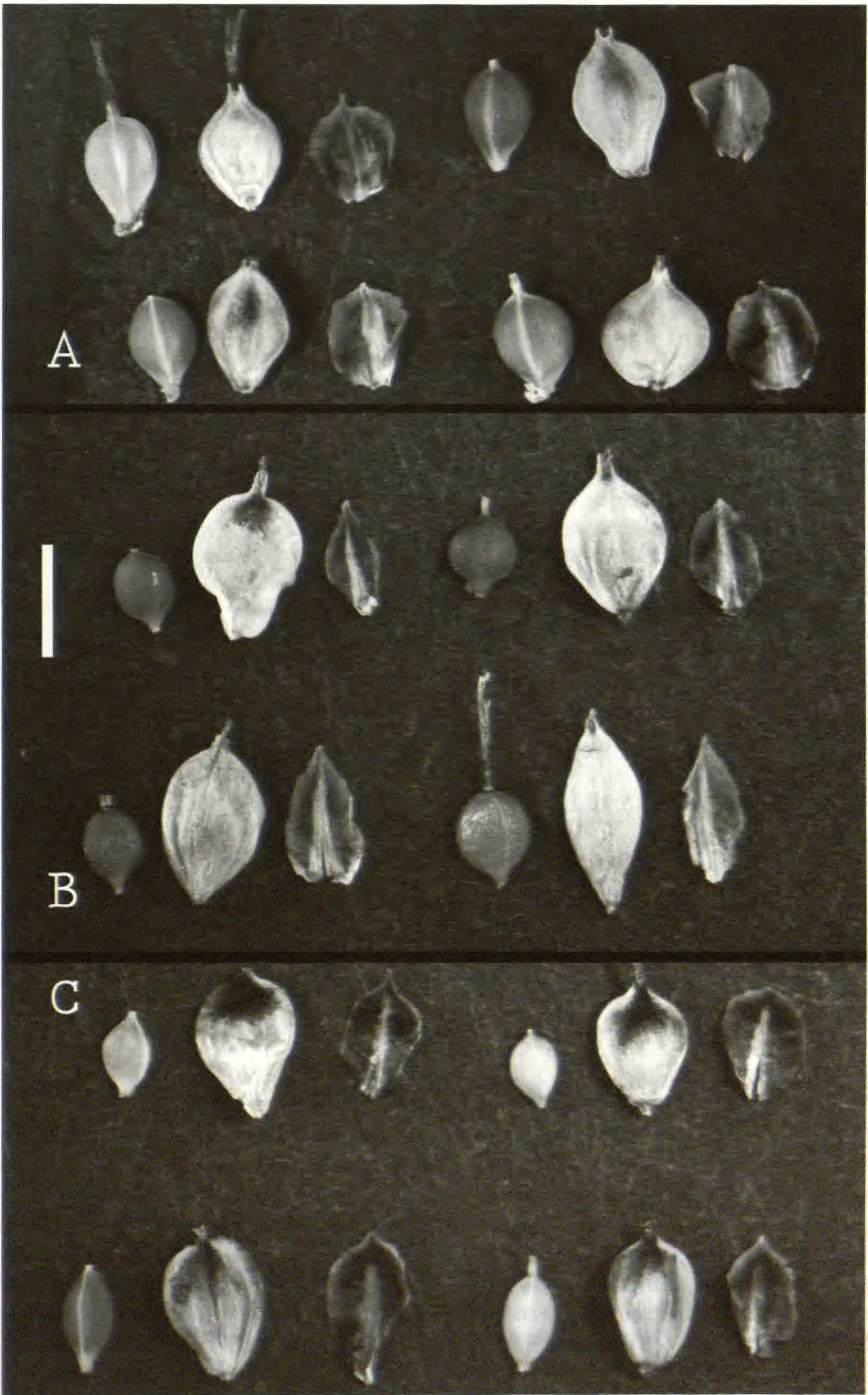


FIG. 4. Perigynia, scales, and achenes of *Carex holmgreniorum* (A), *Carex specuicola* (B) and *C. utahensis* (C). Scale bar = 2 mm.



FIG. 5. Inflorescences of *Carex holmgreniorum* (A) *C. specuicola* (B) and *C. utahensis* (C). Scale bar = 2 cm.

apiculus or awn up to 0.5 mm long. Perigynia 2.6–3.9 mm long, 1.6–2.5 mm wide, ±strongly flattened to concavo-convex in cross-section, ±obovate, not filled by the much smaller achene, herbaceous, papillose distally, green to reddish-purple distally, greenish to brown proximally, 2-nerved and frequently with a few faint nerves on the faces, tapering to a short stipitate base, contracted into an obscure to well defined cylindrical beak; beaks 0.1–0.4 mm long, papillose and sometimes setulose, green to purplish-brown, apex ±erose to obscurely bidentulate with teeth up to 0.1 mm long. Achenes 1.35–2 mm long, 0.9–1.3 mm wide, concavely tapering to a stipe 0.1–0.3 mm long, flattened-trigonous or sometimes lenticular in cross section; the convex sides narrowly elliptic in trigonous achenes, broadly elliptic in lenticular achenes, brown, smooth; apex usually apiculate with an apiculus up to 0.2 mm formed by the persistent style base; style deciduous; stigmas mostly 3, rarely up to 75% 2. Anthers 3, 1.8–2.6 mm long, often with a conspicuous apiculus ca. 0.1–0.3 mm long.

Etymology.—From the state of Utah where the type collection is from.

Seeps, wet slopes, alcoves and hanging gardens, wet meadows, and riparian bottomlands. Elevation 1400–3000 m. Endemic to Utah and adjacent westernmost Colorado.

Plants treated as *C. parryana* in Utah by Goodrich (in Welsh et al. 2003) and mapped by Albee et al. (1988) are this species and also *C. holmgreniorum* (see below).

Carex utahensis appears to be endemic to the northern portion of the Colorado Plateau. It is similar to *C. specuicola* in having achenes much smaller than the perigynia, the perigynia thus loosely fitting around the achene and not filled by it. But *C. utahensis* is a more stiffly erect plant, with darker pistillate scales, and opaque, green and clearly obovate perigynia distinctly purple tinged apically. *Carex specuicola* has a lax, arching habit, paler pistillate scales, and pale greenish, elliptic perigynia changing to whitish and translucent at maturity. A sampling of perigynia, scales, and achenes are noted in Figure 4C and a typical inflorescence from a herbarium specimen is shown in Figure 5C.

Representative specimens. **COLORADO. Montrose Co.:** T47N, 20W, S13, La Sal Creek Cyn, 1.5 mi E of Utah-Colorado border, 16 Jun 1994, Tuhy 3764 (COLO, UTC). **UTAH. Carbon Co.:** T14S R17E, S17, 3 Jun 2000, Atwood 25772 (BRY). **Emery Co.:** jct. U-10 and old hwy to Moore, 8 Jun 1979, White & Moore 85 (BRY); Big East Mt., 8 Aug 1977, Lewis 5125 (BRY); San Rafael Swell, 5 Jun 1979, Harris 326; Straight Canyon, 13 Jun 1989, Tuhy 3545; San Rafael Reef, Cottonwood Wash, 6 May 2001, Yeatts 4573 & Yeatts (KHD). **Grand Co.:** Desolation Canyon, 9 May 1999, Atwood & Evenden 24445 (BRY). **Juab Co.:** Mt. Nebo peak trail from Pole Canyon, 17 Jul 1980, Collins & Harper 937 (BRY). **San Juan Co.:** ca. 1 mi upstream from jct. San Juan R. with Slickhorn Canyon, 1 Jun 2005, Roth 1847 (NAVA); Two Mile Canyon, Lake Powell, 13 May 1983, Welsh & Chatterley 22024 (BRY); John's Canyon bottom, 14 May 2000, Clifford 216 (BRY); Ruin Canyon, 7 Jun 1976, Shultz & Shultz 1900 (BRY). **Uintah Co.:** Firewater Canyon, Moonshine Canyon, 3 Jun 2000, Atwood 25765 (BRY).

3. *Carex holmgreniorum* Reznicek & D.F. Murray, nom. et stat. nov. *Carex parryana* Dewey var. *brevisquama* F.J. Herm., Manual of the Carices of the Rocky Mountains and Colorado Basin 285. 1970. TYPE: UNITED STATES. UTAH: Cache Co.: ¼ mi S of Mendon, 6 Jun 1951, A.H. Holmgren 8251 (HOLOTYPE: US photo!; ISOTYPES: BRY!, CAS!, MICH!, MO!, NY!, UTC!).

Carex aboriginum sensu K.K. Mackenzie. N. Amer. Fl. 18:364, 1935 non *Carex aboriginum* M.E. Jones, Bull. Montana Univ., Biol. Ser. 15:69. 1910.

Illustration.—Mackenzie, K.K. 1940. N. Amer. Caric. 2, pl. 421, as *C. aboriginum*.

Loosely cespitose from short, ascending rhizomes 2–3.5 mm thick, rhizomes ca. 0.5–2 cm long between shoots, rhizome scales brown, disintegrating into coarse fibers; culms 20–90 cm tall, stiffly erect, bluntly trigonous, very finely papillose, 0.6–1.1 mm wide immediately below the inflorescence; phyllopodic, catatriginous, very finely papillose, 0.6–1.1 mm wide immediately below the inflorescence; phyllopodic, catatriginous, very finely papillose, 0.6–1.1 mm wide immediately below the inflorescence; leaves ca. 6–12, essentially basal; blades 3.5–48 cm long, 1.5–4 mm wide, much shorter than culms, ±folded, margins and midrib smooth to finely antrorsely scabrous distally, ±smooth adaxially, papillose abaxially; leaf sheaths 1.5–15 cm long, glabrous, ventrally whitish or pale brown, hyaline, thin, concave at the apex; ligules ca. 0.8–5.5(–7.5) mm long, acute to rounded, slightly shorter than to longer than wide, the free portion whitish to pale brown. Inflorescences 3–9.5 cm long, with 3–5(–6) spikes, terminal staminate or sometimes gynaeandrous, laterals pistillate; upper lateral spikes ±overlapping, lower sometimes separate, lower two spikes 0.7–4.5 cm distant, lowermost ±sessile or on a ±smooth peduncle up to 14.2 mm long; lowest bracts ±bristle-like up to 7.5 cm long and 1.5 mm wide, sheathless, upper bracts abruptly reduced. Terminal spike (6.5–)11.5–27 mm long, pistillate portion (0–)2.5–10 mm long, 4.5–7.2 mm wide, ca. (0–)1–28-flowered, staminate portion 4.5–26.5 mm long, 1.8–3.5 mm wide, ca. 10–65-flowered, peduncle 1.8–38 mm long. Lateral spikes 4–22 mm long, 4–6.8 mm wide, short-cylindric, densely flowered with ca. 5–45 spreading-ascending perigynia. Staminate scales 2.5–4.1 mm long, 1.4–2.4 mm wide, ovate to obovate, reddish-brown with broad hyaline margins, apex obtuse to rounded, with a green, 1–3-nerved center. Pistillate scales 1.6–2.5 mm long, 1.5–2.2 mm wide, reddish-brown to reddish-purple, with broad hyaline margins, broadly ovate to ±circular, obtuse to rounded, green 1–3-nerved center rarely prolonged into a scabrous-ciliate apiculus or awn up to 0.4 mm long. Perigynia 2.5–3.3 mm long, 1.5–2.3 mm wide, rounded trigonous to plumply biconvex, broadly obovate, essentially filled by the achene, coriaceous, finely papillose distally, green to reddish-brown distally, greenish proximally, 2-nerved and sometimes with a few faint nerves on the faces, rounded-tapering to a ±sessile base, contracted into a well-defined cylindrical beak; beaks 0.25–0.5 mm long, finely papillose and sometimes setulose, green to brown, the apex ±erose to obscurely bidentulate with teeth up to 0.2 mm long. Achenes 1.7–2.4 mm long, 1.3–1.6 mm wide, concavely

tapering to a thick stipe 0.1–0.2 mm long, flattened-trigonous in cross section; convex sides narrowly elliptic to obovate, brown, smooth; apex usually apiculate with an apiculus up to 0.2 mm formed by the persistent style base; style deciduous; stigmas 3. Anthers 3, 1.7–3 mm long, with an apiculus ca. 0.1 mm long.

Etymology.—*Carex holmgreniorum* was chosen to honor Arthur H. Holmgren and Noel and Patricia Holmgren, who together have collected this species several times and whose scholarship has contributed so much to our knowledge of the Intermountain flora.

Alkaline seeps, adjacent to springs, riparian zones, moist meadows, pasture land, calcareous and often saline soils, with species such as *Juncus balticus* Willd., *Eleocharis rostellata* (Torr.) Torr., and *Schoenoplectus pungens* (Vahl) Palla. Elevation 1400–2000 m. UNITED STATES. Idaho, Nevada, Utah.

Some of the Utah localities of *C. parryana* mapped by Albee et al. (1988) presumably refer to this species.

Publication of *Carex parryana* var. *brevisquama* by Hermann (1968) lacked a citation of a type specimen as was required by the Code. Valid publication did not occur until 1970 when the name was again published by Hermann with *Holmgren* 8251 as the type for the name (the holotype, and apparently the only sheet seen by Hermann at US, based on his annotation on the sheet). The epithet *brevisquama* was preoccupied at the rank of species by *C. brevisquama* Mack., and a new name must be used.

This is a distinctive species whose lack of recognition was due to its relative rarity and the confusion surrounding the misapplication of the name *C. aboriginum*. It is easily recognized by its combination of large pistillate lateral spikes, staminate or gynaeandrous terminal spike, broad achenes and perigynia, and pistillate scales distinctly shorter than the perigynia. It is an uncommon and local endemic of the northern Great Basin and western portion of the Colorado Plateau. A sampling of perigynia, scales, and achenes are noted in Figure 4A and a typical inflorescence from an herbarium specimen is shown in Figure 5A.

Representative specimens. **IDAHO. Caribou Co.:** Soda Springs, 9 Jun 1993, *Moseley* 2620 (BRY). **NEVADA. Elko Co.:** Point Hot Springs, 4 air mi NE of Ruby Lake National Wildlife Headquarters, 20 Jun 1984, *Atwood* 10222 (NY); Point Hot Springs, Ruby Lake, 20 Jun 1984, *Tiehm* 8745 (BRY, MO). **Eureka Co.:** Hot Spring Hill, Antelope Valley, 8 Jun 2002, *Holmgren & Holmgren* (BRY); Pine valley, 9 Jun 2000, *Tiehm* 13967 (BRY); Antelope Valley, Antelope Wash on N side Antelope Meadow, 5 Jun 2009, *Tiehm* 15793 & *Nachlinger* (NY). **Nye Co.:** Monitor Valley, Dianas Punch Bowl, S of Potts, 12 Jul 1984, *Tiehm* 8941 & *Ertter* (MO). **White Pine Co.:** Steptoe Valley, Duck Creek, 3.3 road mi W of Hwy 93 on road opposite Schellbourne Pass Road, 25 May 2007, *Tiehm* 15380 (NY). **UTAH. Kane Co.:** Willis Creek, *Welsh & Atwood* 28487 (BRY); along Sheep Creek, on E side of bridge for County Road about 3 mi S of jct. with Cottonwood Canyon Road, ca. 5 air mi S of Cannonville, 4 Jul 2008, *Reznicek* 11937 (KHD, MICH, NY, WTU); N side of Willis Creek Road about 3.7 mi W of jct. with Skutumpah Road, 4 Jul 2008, *Reznicek* 11940 (MICH, NY, WTU); Wahweap, 20 Jun 1998, *Atwood & Welsh* 23932 (BRY). **Utah Co.:** American Fork, 4 Jul 1983, *Goodrich* 18853 (BRY); Utah Lake near Saratoga, 23 May 1978, *Brotherson* 2649 (BRY). **Wasatch Co.:** Charleston, 7 Jul 1984, *Goodrich* 20831 (BRY).

4. *Carex parryana* Dewey, Amer. J. Sci. Arts 27:239; t. U, fig 65. 1835. TYPE: CANADA. [MANITOBA]: "Hudson Bay," *Dr. Richardson* s.n. (ISOTYPE: NY!).

Carex arctica Dewey, Amer. J. Sci. 27:239; t. V, fig. 66. 1835. TYPE: CANADA. [Saskatchewan]: Carleton House, *Dr. Richardson* s.n. (ISOTYPE: NY!).

Carex elrodii M.E. Jones, Bull. Montana Univ., Biol. Ser. 15:70; illustration pg. 19. 1910. TYPE: UNITED STATES. MONTANA. [Beaverhead Co.]: Monida, 7000 ft, Jul 8, 1909, M.E. Jones s.n. (ISOTYPES: CAS photo!, MO! NY 2 sheets!, US photo!).

Illustrations.—Mackenzie, K.K. 1940. N. Amer. Caric. II: pl. 412; Cronquist, A. et al. 1977. Intermountain Flora 6:131.

Colonial from short horizontal to \pm ascending rhizomes 1.3–2.7 mm thick, rhizomes ca. 0.7–5.5 cm long between shoots, rhizome scales brown to reddish-purple, disintegrating into coarse fibers; culms 12–65(–70) cm tall, stiff, erect, trigonous, finely papillose with the angles sometimes slightly antrorsely scabrous, 0.5–1.4 mm wide immediately below the inflorescence; phyllopodic, cataphylls and basal sheaths brown, the youngest usually reddish-purple. Leaves ca. 6–12, essentially basal; blades 2–28 cm long, 1.4–4.1 mm wide, much shorter than culms, \pm folded, margins and midrib smooth to papillose, becoming finely antrorsely scabrous distally, \pm smooth adaxially, papillose abaxially; leaf sheaths 2–12.5 cm long, glabrous, ventrally whitish or pale brown, hyaline, thin, concave at the apex; ligules ca. 0.8–3.7 mm long, acute to obtuse, slightly shorter than to longer than wide, the free portion whitish to pale brown. Inflorescences 1.4–8 cm long, with (2–)3–5(–6) pistillate; upper lateral spikes \pm overlapping, lower sometimes separate, lower two spikes 0.3–5.2 cm distant,

lowermost ±sessile or on a papillose and ±scabrous-angled peduncle up to 28 mm long; lowest bracts ±bristle-like up to 5 cm long and 1.2 mm wide, sheathless, upper bracts abruptly reduced. Terminal spike 7.4–25(–30) mm long, pistillate portion (0–)2.1–17.5 mm long, 3–5.1 mm wide, ca. (0–)2–36-flowered, staminate portion (0–)2–24.8 mm long, 1.5–2.8 mm wide, ca. 3–70-flowered, peduncle 1.2–8.7 mm long. Lateral spikes 3–21.4 mm long, 2.5–3.6 mm wide, cylindrical, densely flowered with ca. 3–45 spreading-ascending perigynia. Staminate scales 1.9–3 mm long, 1.2–2.2 mm wide, ovate to obovate, reddish-brown with broad hyaline margins, apex acute to rounded, the distal sometimes with the midvein prolonged into a short apiculus, with a green, 1–3-nerved center. Pistillate scales 2.1–2.7 mm long, 1.3–2 mm wide, reddish-brown to reddish-purple, with broad hyaline margins, broadly ovate, obtuse to rounded, green 1–3-nerved center rarely prolonged into a scabrous-ciliate apiculus or awn up to 0.4 mm long. Perigynia 2.1–2.8 mm long, 1.1–1.6 mm wide, flattened trigonous, the sides elliptic, essentially filled by the achene, coriaceous, finely papillose distally, green to reddish-brown distally, greenish proximally, 2-ribbed and sometimes with a few faint nerves on the faces, cuneately tapering to a ±sessile base, contracted into a short beak; beaks 0.1–0.3 mm long, finely papillose and sometimes setulose, green to brown, the apex ±erose to obscurely bidentulate with teeth up to 0.1 mm long. Achenes 1.3–1.6 mm long, 0.9–1.1 mm wide, ±cuneately tapering to a thick stipe ca. 0.1 mm long, flattened-trigonous in cross section; the convex sides elliptic to obovate, brown, smooth; the apex usually minutely apiculate with the persistent style base; style deciduous; stigmas 3. Anthers 3, 1.5–2.5(–2.7) mm long, including an apiculus ca. 0.1–0.2 mm long.

Moist alkaline margins of lakes and ponds, mudflats and alluvium, and similar conditions in forest openings. 200–2500 m. CANADA. Alberta, British Columbia, Manitoba, Ontario, Saskatchewan, Yukon. UNITED STATES. Alaska, Idaho, Montana, Wyoming.

Carex parryana and *C. arctica* were simultaneously published by Dewey. They were first united under the name *C. parryana* by Torrey (1836, pg. 426).

The location cited from Middlesex County, Ontario (*Oldham 10767*) is clearly an introduction into a saline highway interchange. In western Ontario in the Rainy River District, although also along a road, *C. parryana* co-occurs with other prairie species, and this is more likely a native occurrence, representing the eastern limit of its native range.

Representative specimens. **CANADA. ALBERTA:** W of Edmonton, 17 Sep 1872, *Macoun 31571* (CAN); Assiniboia, Milk R, 9 Jul 1895, *Macoun 10763* (GH, US); Banff, 15 Jul 1891, *Macoun 14049* (GH, NY, US); vic. Rosedale, 5 Jun 1915, *Moodie 943* (GH, NY, US); 10 mi S of Nordegg, 23 Jul 1964, *Smith 591* (MICH); headwaters of Saskatchewan and Athabasca Rivers, Kootany Plains, 12 Aug 1908, *Brown 1500* (NY). **BRITISH COLUMBIA:** ca. 3 mi N of Windermere, 30 Jul 1953, *Calder & Savile 11198* (NY); Eight mi S of 83 Mile House along main Hwy between Williams Lake and Clinton, 24 Jun 1956, *Calder, Parmelee & Taylor 17865* (COLO, MICH, NY, US); 3 mi N of Jesmond, 12 Jul 1956, *Calder, Parmelee & Taylor 18764* (ALA, DAO); six mi on road to Bridge Lake from 70 Mile House, *Calder, Parmelee & Taylor 18837* (MICH); Kamloops, 16 Jun 1889, *Macoun s.n.* (MO); Kamloops, 18 Jun 1889, *Macoun 31573* (CAN). **MANITOBA:** Gypsumville, 140 mi NW of Winnipeg, 13 Jul 1951, *Scoggan 9466* (CAN, WIN); Oak Point, 60 mi NW of Winnipeg, 16 Jul 1951, *Scoggan 9588* (CAN, WIN); Township 3, Range 4, on road between sections 11 and 14, 21 Aug 1996, *Oldham 19367 & Punter* (MICH). **ONTARIO. Middlesex Co.:** North Dorchester Twp., 4.6 km SE of Dorchester Post Office, Hwy 401 at Hwy 73 interchange, 19 May 1990, *Oldham 10767* (MICH). **Rainy River District:** Hwy 11 roadside ca. 2 km W of Seine River Bridge, 18 Jul 1997, *Oldham 20222* (MICH). **SASKATCHEWAN:** Sifton, 27 Jun 1911, *Clokey 663* (MO). Saskatoon, 18 Jul 1934, *Fraser 31* (MICH); One half mi W of Peesane, 7 Jul 1939, *Fraser 232* (ALA, DAO); NE of Strawberry Lake, 6 mi N and 1 mi E of Odessa, 21 Jun 1979, *Ledingham 6094*; 2½ mi E and 3½ mi S of Quantock, 2 Jun 1981, *Ledingham 7036*. **YUKON.** Vicinity of the mouth of Slim's R., Kluane L., approx. Lat. 60°59'N Long. 138°33'W, 11 Jul 1944, *Raup & Raup 12423* (MICH); S end of Kluane L., 6 Aug 1966, *Murray 668* (ALA, NY); Alsek R. valley near mi 1021, Alaska Hwy, 24 Jun 1944, *Raup & Raup 11916* (ALA, GH, MICH, NY); Mi 984.5, Alaska Hwy., 14 Jul 1959, *Taylor 4100* (ALA, DAO), Donjek R crossing at Alaska Hwy., 8 Aug 2003, *Bennett, Elven & Solstad 03/01/0167* (ALA, O). **UNITED STATES. ALASKA:** Anchorage Quad.: Eklutna, 7 Jul 1947, *Dutilly, Lepage & O'Neill 20709* (US); McCarthy Quad.: White R. valley at Alaska Hwy., 5 Jun 2003, *Bennett & Loomis 03-228* (ALA); Chitina R. at terminus Barnard Glacier, 5 Aug 1996, *Duffy & Barnes 96-012* (ALA). **IDAHO. Custer Co.:** 2 mi S of Dickey, 14 Jul 1941, *Cronquist 3106* (GH, MO); Thousand Springs Valley, ca. 6 mi S of Willow Creek Summit, 22 Jun 1983, *Henderson & Cholewa 6601* (NY). **MONTANA. Beaverhead Co.:** Monida, 14 Jul 1908, *Jones s.n.* (POM); tributary stream just N of Simpson Creek, 10 Aug 1997, *Lesica 7503* (ALA); Blacktail Range, ridge just S of Ashbaugh Peak, T9S R8W, S32, 12 Jul 2003, *Lesica 8705* (MICH); ca. 5 mi NE of Lima, 30 Jul 1997, *Lesica 7486* (NY); Nicholia Creek, E of confluence with Rock Creek, 12 Jul 1993, *Lesica 6086* (NY). **Carbon Co.:** Sage Creek ca. 1 mi N of Warren, 27 Jun 1998 *Lesica 7614* (NY); Lloyd's Cabin T8S R29E S28, 9 Jun 1983, *Lichvar 5919* (NY). **Carter Co.:** Headwaters of a Hammond Creek tributary, T1S R62E, Sec. 4 NE ¼, 9 Jun 1997, *Heidel & Cooper 1550* (MICH). **Glacier Co.:** Blackfoot, 24 Jul 1894, *Williams 451* (MONT, RM). **Madison Co.:** along the streams below Wolf Creek Hot Spring S of Cameron, 19 Jul 1990, *Lesica 5184* (MICH); small thermal stream flowing from Trudeau Lake, T7S R4W S7, 28 Jul 1997, *Lesica 7476* (NY); ca. 2 mi SSE of Melrose,

T3S, R9W, Sec. 1 SW ¼, 19 Aug 1997, *Heidel 1612* (MICH). **Powell Co.:** ¼ mi E of Kleinschmidt Lake, T14N R11W S18, 1 Jul 1993, *Lesica 6027* (NY). **Teton Co.:** North Fork Willow Creek, ca. ½ mi SE of Duhr House, 25 mi W of Choteau, 23 Jul 1982, *Lesica 2273* (NY). **Wheatland Co.:** Galloway Creek, ca. 10 mi NE of Harlowton, 26 Jul 1988, *Lesica 4693* (NY). **WYOMING. Sublette Co.:** Jackamore Creek, 21 Jun 1901, *Merrill & Wilcox 609* (GH, NY)

5. *Carex hallii* Olney in Hayden, Rep. U.S. Geol. Surv. Terr. 5:496. 1872 (non L.H. Bailey 1886). TYPE: UNITED STATES. Colorado: *Hall & Harbour 617* (HOLOTYPE: BRU!; ISOTYPES: DUKE fide Weber 1997, n.v., GH!, ISC fide Weber 1997, n.v., NY!, US!). *Carex parryana* Dewey var. *unica* L.H. Bailey, Mem. Torrey Bot. Club 1:54. 1889; *Carex parryana* Dewey var. *hallii* (Olney) Rydb., Mem. New York Bot. Gard. 1:74. 1900 (nom. superfl. and illegit.); *Carex parryana* Dewey subsp. *hallii* (Olney) D.F. Murray, Brittonia 21:71. 1969.

Illustration.—Mackenzie, K.K. 1940. N. Amer. Caric. 2, pl. 411.

Colonial from ±elongate rhizomes 1.2–2.3 mm thick, rhizomes ca. 0.5–16 cm long between shoots, rhizome scales brown, disintegrating into greyish fibers; culms (6–)9–38 cm, stiff, erect, trigonous, the angles sometimes antrorsely scabrous, papillose, 0.4–1.1 mm wide immediately below the inflorescence; phyllopodic, cataphylls and basal sheaths brown, the youngest often reddish-purple tinted. Leaves 4–10, essentially basal; blades 1.8–18(–22) cm long, 1.6–4.3 mm wide, much shorter than culms, ±folded, margins and midrib smooth to finely antrorsely scabrous distally, ±smooth adaxially, papillose abaxially; leaf sheaths 11–7.5 cm long, glabrous, ventrally whitish or pale brown, hyaline, thin, shallowly concave at the apex; ligules 0.5–2.7 mm long, obtuse to rounded, shorter than wide, free portion whitish to pale brown. Inflorescences 1.2–4.5 cm long, with 1–3(–5) spikes, terminal spike staminate (with sometimes 1–3(–8) pistillate flowers at base or apex) or pistillate, rarely mixed, the laterals pistillate; lateral spikes overlapping or separate, the lower two spikes 0.3–0.7(–1.8) cm distant, the lowermost sessile or on a papillose peduncle up to 8.2 mm long; lowest bracts ±bristle-like up to 3.2(–6) cm long, 0.3–0.7(–1.8) mm wide, sheathless or nearly so, upper bracts abruptly reduced. Terminal spike 12–33 mm long; 20–75-flowered and 3.2–5 mm wide when pistillate, 35–90-flowered and 2.2–3.8 mm wide when wholly or largely staminate, the peduncle 2–12 mm long (if lateral spikes present). Lateral spikes, if present, 3–14 mm long, 2.4–3.5 mm wide, cylindric, densely flowered with ca. 3–30 ascending perigynia. Staminate scales 2.6–3.6 mm long, 1.4–2.2 mm wide, ovate, reddish-brown to pale purple with narrow hyaline margins, especially distally, apex broadly acute to rounded, the green, 1–3-nerved center sometimes prolonged into a ±short apiculus on the distal scales. Pistillate scales 1.8–3(–3.2) mm long, 1.4–1.9 mm wide, reddish-brown to reddish-purple, with broad hyaline margins, ovate to ±oblong, broadly to rounded, the green 1–3-nerved center sometimes prolonged into a scabrous-ciliate apiculus or broad awn up to 0.5 mm long. Perigynia 1.7–2.4 mm long, 0.9–1.8 mm wide, ±flattened-trigonous in cross-section, ±obovate, tightly wrapping the achene, ±coriaceous, papillose distally, green to brown, 2-ribbed and frequently with a few faint nerves on the faces, tapering to a short stipitate base, contracted into a short cylindrical beak; beaks 0.2–0.4 mm long, papillose and sometimes setulose, green to purplish-brown, apex bidentulate with teeth up to 0.1 mm long. Achenes 1.3–1.6 mm long, 0.8–1.2 mm wide, cuneately to slightly concavely tapering to the base, flattened-trigonous in cross section; the convex sides obovate, brown, smooth; apex with a tiny apiculus up to 0.2 mm formed by the persistent style base; style deciduous; stigmas 3. Anthers 3, (1.5–)2–3.6 mm long, with a short apiculus ca. 0.1 mm long.

Moist, frequently alkaline, soils of fens, meadows, and prairies. Elevation 200–3400 m. CANADA. Manitoba, Saskatchewan. UNITED STATES. Colorado, Minnesota, Nebraska, South Dakota, North Dakota, Wyoming.

Carex hallii was published by Olney, who contributed the treatment of *Carex* to T. C. Porter's Catalogue of plants (pp. 477–498) in the Preliminary Report of the United States Geological Survey of Montana and Portions of Adjacent Territories by Hayden (1872). In what is otherwise a list of species, Olney included text bounded by quotes consisting of a description, etymology of the name, and citation of a specimen, *Hall & Harbour 617*. In addition to this protologue, but outside of the quotes, was added the location "Pleasant Valley," representing a specimen also thought (by Porter?) to be *C. hallii*. This "Pleasant Valley" specimen has been treated as the type, starting with Mackenzie's (1935) citation of the type locality as "Pleasant Valley, Idaho" and also by Murray (1969) who followed Mackenzie and noted "There is a specimen from the Rocky Mountains, Jun 1871, *Hayden s.n.* (NY!). This should be the lectotype if no better Hayden material can be found." We argue

here that Olney's *C. hallii* was clearly based on *Hall & Harbour 617* in Olney's herbarium (BRU!), which was cited inside the quotes, and clearly fits the protologue, which calls for a specimen that "... resembles *C. scirpoidea* when the latter has a second small spike. ..." This specimen was most likely collected in South Park, Colorado (Weber 1997). The Hayden specimen from Pleasant Valley is in conflict with the protologue, having two substantial lateral spikes, thus not at all like "... *C. scirpoidea* when the latter has a second small spike ..." and is in fact *C. idahoensis*. Pleasant Valley is located in the northeast corner of Yellowstone National Park in present day Park Co., Wyoming, near the Montana Border at 44°55'45"N, 110°25'17"W (J. Reveal, pers. comm.).

Carex hallii exhibits an unusual sex distribution in the inflorescences. Terminal spikes are usually either staminate or pistillate, with rarely one or a few pistillate flowers at the base or apex of the predominantly staminate spikes, and occasionally a very few staminate flowers, often scattered, in the pistillate spikes. However, lateral spikes, if present, are always pistillate regardless of the sex of the terminal spike. This feature appears to be distributed clonally; observations of several populations in Colorado determined that clones have either predominately staminate or predominately pistillate terminal spikes.

Carex hallii reports from California, as *C. parryana* var. *hallii* (e.g., Mastrogiuseppe 1993), were redetermined as *C. idahoensis*. See the discussion under *C. idahoensis*.

Representative specimens. **CANADA. MANITOBA:** Brandon, 24 Jun 1951, *Stevenson 374* (ALA); Oak R. at Lothair, 21 Jun 1906, *Macoun & Herriot 72728* (CAN, NY, US); Pierson Wildlife Management Area, 7 mi SW of Pierson, 29 May 1975, *Knapton 37* (WIN). **SASKATCHEWAN:** Moose Mt., 7 mi S of Kennedy, 13 Jul 1951, *Boivin & Dore 7798* (DAO). **UNITED STATES. COLORADO. Chaffee Co.:** Monarch Pass, 20 mi W of Salida, 22 Jun 1926, *Erlanson 2020* (MICH). **Clear Creek Co.:** Silver Plume, 3 Jul 1922, *Ehlers 132* (MICH, NY). **El Paso Co.:** Ruxton Canyon, Pike's Peak, 30 Jul 1922, *Ehlers 609* (MICH, NY); 4½ mi E of Falcon, 22 Aug 1946, *Livingston 1430* (COLO). **Gunnison Co.:** Gunnison Basin, lower Quartz Creek, 7 mi N of Parlin, 9 Jul 1994, *Weber & Wittmann 19051* (COLO). **Lake Co.:** Lake Creek, 17 Jul 1919, *Clokey 3332* (ALA, COLO, GH, LCU, MICH, MO, NY, RM, US, UTC); Twin Lakes, 4 Jul 1919, *Clokey 3333* (ALA, GH, MICH, MO, NY, RM, US, UTC). **Larimer Co.:** Fall River Valley, Horseshoe Park, Rocky Mt. Nat. Park, 12 Jun 1961, *Kornas & Willard s.n.* (COLO); Soapstone Prairie, City of Fort Collins Natural Area, 25 mi N of Fort Collins just S of Wyoming state line, 23 Jun 2011, *Wingate 9052* (KDH, MICH). **Park Co.:** South Park, 1873, *Wolfe s.n.*, (MICH, NY); South Park, 10 Aug 1927, *Hanson 2687* (MO); South Park at Jefferson, 17 Aug 1960, *Weber, Porsild & Holmen 11,103* (COLO); Geneva Creek, T6S R75W, 9 Aug 1970, *Gierisch s.n.* (COLO); Slater Ditch, Elkhorn Rd. ca. 1½ mi SE of Cline Reservoir, 29 Jun 1985, *Neely 2998* (COLO); Antero-Salt Creek Natural Area, ca. 17 mi S of Fairplay and ca. 1 mi W of US285 off Pony Park Road, 3 Aug 2011, *Wingate 9208 Regensberg & Clark* (KHD, MICH); E side of Four Mile Creek Road ca. 4.5 air mi SW of Fairplay, 16 Aug 2012, *Reznicek 12143* (KHD, MICH); W side of South Park, 5 mi S of Fairplay, 23 Aug 1997, *Weber & Wittmann 19254* (COLO); Lost Park Road (CR 56), Johnson Gulch tributary of Rock Creek, 18 Aug 2012, *Reznicek 12147* (KHD, MICH, NY, WTU); along County Road 62, paralleling Geneva Creek, ca. 4.5 air mi NW of Grant (jct. US Hwy 285), opposite road from Burning Bear Campground, 18 Aug 2012, *Reznicek 12149* (MICH). **Summit Co.:** Breckenridge, Aug 1901, *Mackenzie 382* (NY). **NEBRASKA. Kearney Co.:** Minden, 26 May 1898, *Hapeman s.n.* (MICH, MO, NY), 9 May 1913, (MO); 23 May 1927 (ALA, GH, NY, RM, US); Lexington, 16 Jun 1929, *Hapeman s.n.* (UTC). **NORTH DAKOTA. Benson Co.:** Leeds, 10 & 19 Jun 1905, *Lunell s.n.* (MICH, NY). **WYOMING. Laramie Plains, 20 Jul 1884, Sheldon (MICH). **Albany Co.:** Laramie, 19 Jun 1894, *Nelson 274a* (NY); 31 May 1897, *Nelson 2943* (MICH). **Carbon Co.:** Big Creek, 10 Jul 1901, *Tweedy 4325* (NY, US). **Goshen Co.:** near North Platte River at Nebraska state line, 6 Jun 1964, *Johnson 412* (MICH). **Laramie Co.:** Pine Bluffs, 15 May 1897, *Nelson 2901* (NY); Centennial, 26 Jul 1900, *Nelson 7682* (NY). **Platte Co.:** Cold Springs, 13 Jul 1894, *Nelson 447* (MO); Battle Lake, 16 Aug 1897, *Nelson 4020* (UTC).**

6. *Carex idahoensis* L.H. Bailey, Bot. Gaz. 21:5–6. 1896. TYPE: UNITED STATES. IDAHO: Beaver Canyon, P.A. Rydberg 2339. (Of two duplicate sheets at US!, 235569 is here designated LECTOTYPE; ISOLECTOTYPE US! 235568). *Carex parryana* Dewey subsp. *idahoensis* (L.H. Bailey) D.F. Murray, *Brittonia* 21:73. 1969.

Carex parryana Dewey var. *statoni* M.E. Jones, *Bull. Montana Univ., Biol. Ser.* 15:72; illustration pg. 71. 1910. TYPE: UNITED STATES. MONTANA. [Powell Co.]: Ryan's, Deer Lodge Valley, 5300 ft, M.E. Jones s.n., Aug 3, 1905. (HOLOTYPE: Herb. M.E. Jones, POM [photo!]).

Illustration.—Mackenzie, K.K. 1940. *N. Amer. Caric.* 2, pl. 410.

Loosely cespitose to slightly colonial from ±elongate rhizomes 1.7–2.7 mm wide, rhizomes ca. 0.5–10 cm long between shoots, rhizome scales pale brown, rapidly disintegrating into fibers; culms (6–)10–48 cm, ±erect, trigonous, smooth to finely papillose or somewhat scabrous-angled, 0.6–1.1 mm wide immediately below the inflorescence; phyllopodic, cataphylls and basal sheaths pale to dark brown, the youngest tinged reddish-purple. Leaves 4–12, essentially basal; blades 2.5–22 cm long, 1.3–5.5 mm wide, shorter than culms, ±folded, the margins and midrib smooth to finely antrorsely scabrous distally, ±smooth adaxially, ±papillose abaxially, especially distally; leaf sheaths ca. 2–12.5 cm long, glabrous, ventrally whitish or pale brown, sometimes finely brown streaked, hyaline, thin, concave at the apex; ligules ca. 0.6–1.5 mm long, obtuse to rounded,

shorter than wide, free portion whitish to pale brown. Culms apparently unisexual (and plants presumably dioecious, but field observations unavailable); Pistillate inflorescences 1.6–5.3 cm long, with 1–3(–4) spikes; lateral spikes, if present, ±overlapping, the lower two spikes 0.6–1.7 cm distant, the lowermost ±sessile or on a ±papillose and scabrous-angled peduncle up to 8.5 mm long; lowermost bracts scale-like to bristle-like, blades up to 1.8 cm long and 1.6 mm wide, sheathless, upper bracts abruptly reduced. Terminal spike 12.5–34 mm long, (4.5–)5.5–9 mm wide, ca. 30–60-flowered. Lateral spikes 5.5–17.5 mm long, ca. 3–5.5 mm wide, cylindrical, ca. 8–28-flowered. Staminate inflorescences poorly known, ca. 1.6–3.7 mm long, with 1–3 spikes; lateral spikes, if present, ±overlapping, the lower two spikes ca. 0.4–1.3 cm distant, the lowermost ±sessile; lowermost bracts scale-like to bristle-like, blades observed up to 1.1 cm long and 0.8 mm wide, sheathless, upper bracts abruptly reduced. Terminal spike ca. 14–22.5 mm long, ca. 4–4.5 mm wide, ca. 40–60-flowered. Lateral spikes ca. 4.5–15.5 mm long, ca. 1.5–3 mm wide, cylindrical, ca. 8–25-flowered. Staminate scales 3.2–5.1 mm long, 1.9–3.2 mm wide, ovate, dark reddish-brown or purple-brown with broad hyaline margins and green 3-nerved center, the apex obtuse to acute. Pistillate scales (2.1–)2.4–4.6 mm long, 1.2–2 mm wide, dark reddish-brown to purple-black, with at most narrow hyaline margins, broadly to narrowly ovate to elliptic, obtuse and cuspidate to acuminate, with a green to reddish purple 1-nerved center. Perigynia 2.1–2.7 mm long, 1.3–2 mm wide, ±strongly flattened-trigonous in cross-section, broadly elliptic to obovate, ±coriaceous, somewhat papillose distally, green to brown, often reddish-purple tinged on and near the base of the beak, 2-ribbed, tapering to a short stipitate base, ±abruptly contracted into a cylindrical beak; beaks 0.2–0.5 mm long, smooth to somewhat papillose, sometimes slightly setulose, green to purplish-brown, apex ±erose to bidentulate with teeth up to 0.1 mm long. Achenes 1.5–1.8 mm long, 0.9–1.2 mm wide, cuneately tapering to a short stipe ca. 0.1 mm long, trigonous in cross section; the convex sides obovate, brown, smooth; apex apiculate with an apiculus up to 0.1 mm formed by the persistent style base; the style deciduous; stigmas 3. Anthers 3, ca. 2.8–4.5 mm long, with a short, triangular apiculus ca. 0.1 mm long.

Moist margins of seasonally moist calcareous meadows where the surrounding vegetation is steppe. Elevation 1400–3200 m. UNITED STATES. California, Idaho, Montana, Oregon, Utah, Wyoming.

We have not seen specimens of *Carex idahoa* from Oregon, but the photographs in Wilson et al. (2008) are convincing.

In order to be consistent with the International Code of Botanical Nomenclature, Boivin (1979, p. 87) considered the correct spelling of the epithet to be *idahoana*, the adjectival form of Idaho. While *idahoana* may be more correct linguistically, the spelling *idahoa* is not a correctable error covered by the Code, and we retain Bailey's original spelling.

The distinctive dark color of the scales in *Carex idahoa* fades late in the season to a dull brown (though still darker than *C. hallii* or *C. parryana*), and then it may resemble a robust *C. hallii* in having the lateral spikes small, with the terminal spike (1.2–)1.5–3.3 times as long as the longest lateral or more, and also in having the terminal spike unisexual. However, *C. idahoa* mostly (about $\frac{2}{3}$ of the time in a sample of 50 inflorescences) has 2 lateral spikes; only about 25% of plants have a single lateral spike and only about 8% are unispicate. This is different from *C. hallii* where 87% of the inflorescences have only one lateral spike or are unispicate. Furthermore, though male inflorescences are poorly represented in herbaria, *C. idahoa* appears to be dioecious, with both the lateral spikes and the terminal spike male, while in *C. hallii*, the lateral spikes are female, regardless of the sex of the terminal spike.

California plants noted as *Carex parryana* var. *hallii* (Mastrogiuseppe 1993) are here referred to *C. idahoa*, and were treated as such in the recent revision of the California flora (Zika et al. 2012). However, although they are similar in overall appearance and in being dioecious, they tend to be smaller than Rocky Mountain plants, with somewhat narrower spikes (the widest terminal spikes ca. 4.5–5.7 mm wide), and the pistillate scales, though dark and longer than the perigynia, are also shorter (the longest 2.2–2.5 mm long), and blunter than typical for Rocky Mountain plants. More collections and study are needed here. With a larger sample, also including Oregon collections, to provide a clearer view of their variability, it may be that the California plants will prove worthy of formal recognition.

Representative specimens. **UNITED STATES. CALIFORNIA. Mono Co.:** White Mts., Spring 75 m W of the dry bed of Poison Creek 0.25 km S of confluence with Cottonwood Creek, Cottonwood Basin, 4.3 air mi ENE of Sheet Mt., 7 Aug 2012, Zika et al. 26045 (ALA, MICH); White Mts., Granite Meadow, Cottonwood Basin, 4.3 air mi ENE of Sheet Mt., 7 Aug 2012, Zika et al. 26047 (ALA, MICH); White Mts., 0.65 mi SW of Station Peak at Deep Springs, 13 Aug 1983, Morefield JDM-1698 (NY); White Mts., N Fork Cottonwood Creek, 1.8 mi NE of Eva Belle Mine, 12 Jul 1987, Morefield et al. 4611 (NY). **IDAHO. Bannock Co.:** Blackfoot R, 2–11 Sep 1913, W.W. Eggleston 9985 (US). **Bonneville Co.:** Gray's Lake, 47 mi SE Idaho Falls, 19 Jul 1945, Christ & Ward 14999 (NY). **Nez Perce Co.:** Beaver Canyon Meadow, T35N R4W S10, Aug 1895, Shear 5391 (NY, RM). **MONTANA. Beaverhead Co.:** Monida, 8 Jul 1909, Jones s.n. (MICH, MO, NY); 4 mi N of Jackson, 8 Sep 1955, Hermann 12485 (MICH); W of Upper Red Rock Lake, 10 Sep 1955, Hermann 12490 (MICH); Beaverhead Mtns, along Cottonwood Creek ca. 1 mi W of Lower Harkness Lake, 31 Jul 1990, Lesica 5208 (MICH); E Morrison Lake T14S R12W S23, 29 Jul 1989, Lesica & Cooper 4979 (NY); Tendoy Mtns, along Sourdough Creek, 9 Jul 1993, Lesica 6066 (MICH); Tendoy Mtns, along Nicholia Creek just E of the confluence with Rock Creek, 12 Jul 1993, Lesica 6088 (MICH); ca. 1 mi N of Box Spring, 20 Jun 1995, Lesica 6762 (MICH); along a small spring 1 mi S of Basin Creek, 29 Jun 1995, Lesica 6792 (MICH); hills W of Sand Creek, 1 Aug 1997, Lesica 7493 (ALA); Hildreth Ranch, 30 Jul 1997, Lesica 7484 (ALA); head of Clover Creek, T13S R6W S1, 1 Aug 1997, Lesica 7495 (NY); along Coyote Creek, Coyote Lake, T15S R11W S7, 10 Aug 1997, Lesica 7502 (NY); along Taylor Creek just below Taylor Mine, T7S R11W S18, 29 Jul 1997, Lesica 7479 (NY). **Custer Co.:** 18 mi SW of Mackay, 22 Jul 1965, Hermann 20106 (MICH, NY). **Gallatin Co.:** Spanish Basin, 28 Jun 1897, Rydberg & Bessey 3813 (NY); Mystic Lake, 25 Jul, Shear 485 (NY). **Madison Co.:** Grassy Lake, 27 Jul 1997, P. Lesica 7470 (ALA), Forks of the Madison, 26 Jul 1897, Rydberg & Bessey 3762 (NY). **Powell Co.:** Deer Lodge, Rydberg 2128 (NY, US). **Silver Bow Co.:** Butte Highlands, Moose Creek, 22 Jul 1981, Lackschewitz 9728 (ALA, NY); T3N R9W S13, 8 Jul 1895, Shear 5462 (NY). **UTAH. Wasatch Co.:** T4S R10W S6 E½, SE of Heber City, Strawberry Valley, Windy Ridge, 1 Jul 1983, Goodrich 18815 (NY). **WYOMING. Park Co.:** Pleasant Valley, Jun 1871, Hayden s.n. (NY). **Teton Co.:** Expedition of Capt. W.F. Reynolds to the head waters of the Missouri and Yellowstone rivers, Gros Ventre Pass, 6,500 ft, 18 Jun 1860, Hayden, s.n. (BRU).

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